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OFFICIAL

Serial No. 10/002,746

IN THE UNITED STATES
PATENT AND TRADEMARK OFFICE

Patent Application

Inventors Amab Das
Farooq Ullah Khan

Case 14-18

Serial No. 10/002,746

Filing Date November 2, 2001

Examiner Thuan T. Nguyen

Group 2685

Title Variable Rate Channel Quality Feedback In a Wireless Communication System

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450AMENDMENT

Sir:

In response to the Office Action dated October 2, 2003, please enter the following amendments and remarks in the above-identified application, in which:

Amendments to the claims begin on page 2 of this paper; and

Remarks begin on page 5 of this paper.

CERTIFICATION OF FACSIMILE TRANSMISSION	
I hereby certify that this paper is being facsimile transmitted to the Patent and Trademark Office on the date shown below.	
<u>Gregory A. Murgia</u>	<u>2/2/04</u>
Gregory A. Murgia	Date

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In the Claims**Please substitute the following claims for those currently on file in the application:**

1. (Currently Amended) A method for transmitting channel quality information in a wireless communication system comprising at least one base station and at least one mobile station, the method comprising:

varying a rate for reporting channel quality information from a mobile station to a base station as a function of the presence or absence of a reception of a data transmission at the mobile station, wherein the mobile station reports channel quality information at a first rate in the absence of a reception of a data transmission from the base station and, upon detection of a reception of a data transmission from the base station, the mobile station reports channel quality information at a second rate for a prescribed duration.

2. (Canceled)

3. (Canceled)

4. (Currently Amended) The method according to claim 1, ~~wherein the mobile station reports channel quality information at a first rate in the absence of a reception of a transmission from the base station and, upon detection of a reception of a data transmission from the base station, the mobile station reports channel quality information at a plurality of rates over a prescribed time period after detection of the reception of a data transmission, wherein the plurality of rates are different than the first rate.~~

5. (Currently Amended) The method according to claim 4, wherein the prescribed time period includes a plurality of time intervals such that the channel quality information is reported at different ones of the plurality of rates during different ones of the plurality of time intervals.

6. (Currently Amended) The method according to claim 2 1, wherein the second rate is faster than the first rate.

7. (Currently Amended) The method according to claim 6 1, further comprising the step of estimating channel quality at the base station while the mobile station is reporting at the second rate, wherein estimated channel quality is used to derive a transmission format for a subsequent transmission.

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8. (Original) The method according to claim 7, wherein the transmission format includes one or more parameters selected from the group consisting of modulation format, number of codes, and transmission rate.

9. (Currently Amended) The method according to claim 6 1, further comprising the step of estimating channel quality at the base station while the mobile station is reporting at the second rate, wherein estimated channel quality is used to calculate an amount of redundancy needed for a retransmission of a previous data transmission.

10. (Original) The method according to claim 1, wherein the channel quality information comprises a transmission rate calculated by the mobile station based on one or more channel conditions.

11. (Currently Amended) A method for adapting the rate of reporting channel quality information in a wireless communication system including at least one base station and at least one mobile station, the method comprising:

reporting channel quality information from the at least one mobile station to the at least one base station at a first rate in the absence of a reception of a data transmission at the at least one mobile station; and

in the presence of a reception of a data transmission at the at least one mobile station, adapting the rate for reporting channel quality information from the at least one mobile station to the at least one base station from the first rate to a second rate for a prescribed duration.

12. (Original) The method according to claim 11, wherein the second rate is faster than the first rate.

13. (Original) A method for transmitting channel quality information in a wireless communication system including at least one base station and at least one mobile station, the method comprising:

varying a rate for reporting channel quality information from a mobile station to a base station as a function of the number of base stations that the mobile station is communicating with.

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14. (Original) The method according to claim **13**, wherein the mobile station reports channel quality information at a first rate when the mobile station is communicating with one base station and wherein the mobile station reports channel quality information at a second rate when the mobile station is communicating with a plurality of base stations.

15. (Original) The method according to claim **14** wherein the second rate is faster than the first rate

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REMARKS

By this amendment, claims 1, 4-7, 9 and 11 have been amended and claims 2-3 have been canceled. Accordingly, claims 1 and 4-15 are still pending in the application for further consideration by the Examiner.

35 U.S.C. 102(b) Rejection

Claims 1-15 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 6,067,458 ("Chen"). Claims 1, 4-7, 9 and 11 have been amended, claims 2-3 have been canceled, and all rejections of the remaining claims are respectfully traversed as set forth below.

Claims 1-12

Briefly, the Chen reference appears to be directed to controlling the power level of transmissions between base stations and mobile stations and, in particular, to controlling power for higher rate data transmissions. Applicants acknowledge that Chen describes and it is well known for a mobile station to send power control information (e.g., messages) to a base station corresponding to the measured power level received at the mobile station. Furthermore, Applicants acknowledge that Chen describes how a variable rate vocoder is used to transmit voice and/or data at a plurality of rates over a link, e.g., col. 6, lines 10 et seq.

However, Applicants respectfully submit that Chen does not teach or suggest every limitation set forth in Applicants' claims and, as such, does not anticipate Applicants' claims. Applicants' claim 1, as amended, recites that the mobile station reports channel quality information at a first rate in the absence of a reception of a data transmission from the base station and, upon detection of a reception of a data transmission from the base station, the mobile station reports channel quality information at a second rate for a prescribed duration. Independent claim 11 recites similar limitations.

Chen is only concerned with power control and, as such, only describes a mobile station transmitting power control information to a base station, wherein power control information is characterized throughout the specification as either a signal corresponding to the measured power level, a signal or message indicating that the power level deviated from a predefined threshold, or other similar variations of communicating the power information. By contrast, Applicants' independent claims 1 and 11 each recite the mobile station reporting channel quality information to the base station, which Applicants respectfully submit is different than power control information. While the Office Action references one statement in Chen (e.g., col. 14, lines 35-39) in which the patentee obliquely mentions that the invention would be applicable to a "communication system that operates in accordance with the claims to provide channel quality monitoring and power control", Applicants respectfully submit that this statement alone does not

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supply an anticipatory and enabling teaching for a mobile station reporting channel quality information in the manner in which it is now being claimed by Applicants.

Notwithstanding at least the above distinction, Applicants respectfully submit that Chen also fails to teach or suggest varying the rate for reporting channel quality information from a mobile station as a function of the absence or detection of a data transmission from the base station.

In FIG. 7 and the accompanying description in col. 11, lines 35 et seq., Chen describes a routine for changing power levels for sending data at a high rate after sending data at one of the low rates. More specifically, Chen describes the base station operating at an idle rate, e.g., sending no voice/data to the mobile. After data is "presented to the base station" for a high rate transfer to the mobile (col. 11, lines 49-50), the base station (step 330, FIG. 7) first sends a signal to the mobile station to increase the bandwidth of the power control information transmitted by the mobile (col. 11, lines 64-67). According to Chen, increasing power control bandwidth causes power control information to be sent at a higher rate from the mobile (col. 11, line 67 to col. 12, line 3). More specifically, Chen clearly discloses that the base station sends an encoded signal to the mobile, which then decodes the signal and, in response thereto, increases the bandwidth of its power control information, e.g., by transmitting one or more power control messages per several frames (col. 12, lines 3-13). Chen describes that this increased power control information is necessary to predict the power needed to then subsequently transmit data at the higher data rate (col. 12, lines 14-62).

Again, in col. 13, lines 48 to col. 14, line 41, Chen describes generally that the routine shown in FIG. 7 allows the mobile and base station to estimate and test the proper power level before sending data at a higher rate and, in particular, that the transmission rate of power control information can be increased from the mobile so that the base station can estimate the proper power level for transmitting subsequent frames of data at high rates to the mobile. Consequently, all teachings in Chen describe increasing power control feedback from the mobile based on the base station sending a message or signal instructing such action in preparation for a subsequent high data rate transmission.

By contrast, Applicants' claimed invention sets forth a mobile station that changes its rate of transmitting channel quality information based on the mobile's detection of the absence or presence of a data transmission from the base station. That is, the mobile station receives a data transmission from the base station and, in response thereto, begins transmitting channel quality information back to the base station at a second rate. Using the actual data transmission from the base station as a trigger for the mobile station to change its rate of transmitting channel

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quality information back to the base station is quite different from using a separate signaling message from the base station to the mobile telling the mobile to transmit more power control information (i.e., so that the base station can then adjust power for the subsequent higher speed data transmission) as described by Chen.

Furthermore, Applicants respectfully submit that neither the cited portion of Chen (col. 6, lines 18-48) nor any other portion of the reference teaches or suggests a mobile station that, upon detection of a reception of a data transmission, reports channel quality information at a second rate for a prescribed duration. In particular, Chen only teaches that the bandwidth, and hence the rate of transmission, of power control information from the mobile station is increased in response to the instruction from the base station. Chen fails to teach or suggest transmitting this information at a different rate for a prescribed duration.

Among other advantages, transmitting channel quality information at a second rate for a prescribed duration as set forth in Applicants' claims addresses the problem of delay with respect to uplink transmissions (from the mobile) and downlink transmissions (from the base station). In particular, there is delay with respect to the calculation of rate information by the mobile during a time slot and the subsequent reporting of that rate (vis-à-vis channel quality feedback) to the base station, see, e.g., Applicants' specification on page 2, line 8-33. By way of example, this delay can cause problems in adapting the rate of channel quality feedback (and subsequent changes to transmission rate), especially when dealing with the bursty nature of data traffic (e.g., all packets may not come at once or in immediate succession). In particular, reporting channel quality information at a second rate for a prescribed duration as claimed by Applicants will solve the problem of undesirable (e.g., premature) switching back and forth between rates just because there may be some gaps in packet transmission. By maintaining transmission of channel quality information at a second rate for a prescribed duration as claimed by Applicants, insignificant gaps in packet transmission will not trigger an unnecessary switch in the feedback rate (see, e.g., Applicants' specification, page 6, line 26 through page 7, line 27). Applicants respectfully submit that there are no such teachings in Chen.

Because Chen fails to teach or suggest every recited limitation in claims 1 and 11 (as amended), Applicants submit that Chen therefore does not anticipate claims 1 and 11 and respectfully request that the Examiner withdraw the rejections accordingly.

Because claims 4-10 and 12 each depend from respective base claims 1 or 11, these dependent claims are therefore also believed to be allowable for the same reasons set forth above for claims 1 and 11 as well as for other novel features therein.

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With regard to claim 8, for example, Chen does not teach or suggest estimated channel quality being used to derive a transmission format for a subsequent transmission, wherein the transmission format includes one or more parameters selected from modulation format, number of codes, and transmission rate. As previously discussed, Chen only teaches deriving the proper power level for a subsequent high-speed transmission. That is, the base station receives a data transmission that is to be transmitted at a higher rate (defined a priori) and, upon receiving the power control information from the mobile station, the base station then adjusts the power level to a proper level for transmission of the higher rate data transmission. As such, there is no teaching in Chen for deriving modulation format, number of codes, and/or transmission rate for a subsequent transmission after estimating channel quality based on feedback from the mobile, as is now being claimed by Applicants.

With regard to claim 9, Applicants respectfully disagree that the cited portions or any other portions of the Chen reference teach or suggest a base station receiving channel quality information from a mobile, estimating channel quality therefrom, and then calculating an amount of redundancy for retransmissions accordingly. At most, Chen describes transmitting a new transmission to a mobile using a previously stored power level for the link. This teaching is not at all the same or even suggestive of using estimated channel quality to calculate an amount of redundancy for retransmission of a previous transmission as claimed by Applicants.

Claims 13-15

Applicants also respectfully submit that Chen does not teach or suggest every limitation recited in independent claim 13. The distinctions noted above for the Chen reference and Applicants' claims 1 and 11, relating to channel quality information as claimed by Applicants versus power control information as disclosed by Chen, apply equally to claim 13 and will not be repeated here for sake of brevity. Furthermore, there are absolutely no teachings in Chen, nor are any cited in the Office Action, that either expressly or impliedly suggest varying the rate for reporting channel quality information as a function of the number of base stations that the mobile is communicating with, as is recited in Applicants' claim 13. This feature of Applicants' claimed invention, which is particularly advantageous for handling "soft handoffs", is supported in Applicants' specification, see, e.g., page 9, lines 1-22.

Because Chen does not teach or suggest each of the limitations recited in claim 13, Applicants' submit that the Chen reference therefore does not anticipate claim 13 and respectfully request that the Examiner withdraw the rejection accordingly. Because claims 14 and 15 depend from claim 13, these dependent claims are therefore also believed to be

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allowable for the same reasons set forth above for claim 13 as well as for other novel features therein.

Conclusion

In view of the foregoing, Applicants believe that all pending claims stand in condition for allowance. Accordingly, Applicants respectfully request reconsideration of the application and passage of the case to issue. Any questions can be directed to the Applicants' attorney at the number below.

Respectfully submitted,

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